The SELETORA

Centrifuge / MiniSpin

BUILDING MANUAL

Team USP_UNIFESP-Brazil

Open Hardware

iGEM 2016

Summary:

As part of our project, we assembled a mini centrifuge to meet our lab necessities. The project was done as an Open Hardware and here we have the materials and instructions needed for assembly. The project idea was initially a design from BioHack Academy, but was then further developed and modified by our team. The total cost couldn't be calculated, but was estimated to be at around 90 dollars.

Name origin:

The name "Seletora" is an adjective in portuguese which means "sorting" or "selecting". This came up as an inside joke, due to the existence of one (and, at first, only one) selecting button and the previous construction of a Harry Potter Like Sorting Hat by Bruno Aricó, one of our team members.

The Seletora centrifuge selects one of the four houses of Hogwarts every time it is turned on. Does the house you are put on affect the outcome of your experiments?? Check it for yourself!

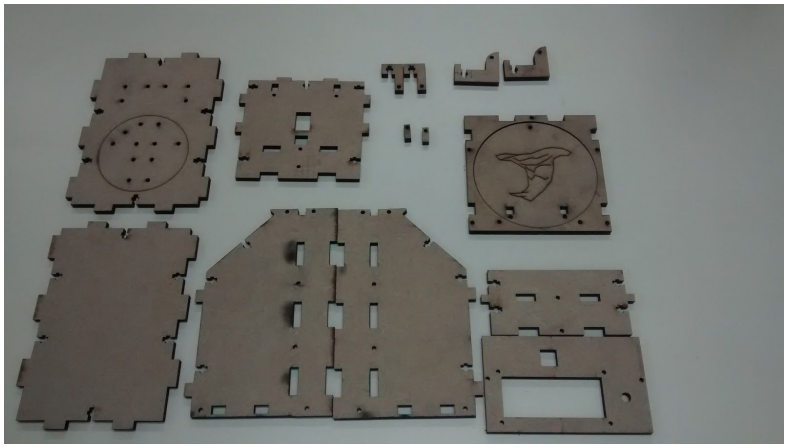
Components

- 1 DC brushless motor like a EMAX 2822
- 1 ESC 30A (Electronic Speed Controller)
- 1 P3 power jack (Female/Male)
- 1 Rotary encoder
- 1 Spinner
- 1 Knob
- 1 I2C LCD Interface
- 1 LCD 16x2
- 1 Push Button 12 x 12 mm
- 1 Power Switch
- 1 12V 5A (or more) power supply
- 1 10K resistor 1/4W
- 1 Arduino pro mini
- 2 2-pin Header Pin Socket and Plug*
- 2 3-pin Header Pin Socket and Plug*
- 1 4-pin Header Pin Socket and Plug*
- 1 5-pin Header Pin Socket and Plug*
  *Reference to pins in general is here
- 1 Hall Sensor like a US1881
- 1 XT60 connector
- 3 Bullet connectors
- 1 Female header
- 1 Male header
- 2,0m of wire 2mm (in different colors, don't forget red and black!)
- Water proof varnish
- 2,0m of 2mm heat-shrink tube
- 50 M3 Screw 15mm
- 50 M3 Nuts
- 1 Sheet of 50cm x 50cm 6mm MDF
- 1 Sheet Fenolite 10cm x 10cm, 1 layer coppered
- PLA or ABS filament
- Hot glue
- General tools
- 1 Arduino UNO (only to upload the code in Arduino pro mini)
- Arduino 1.6.X installed

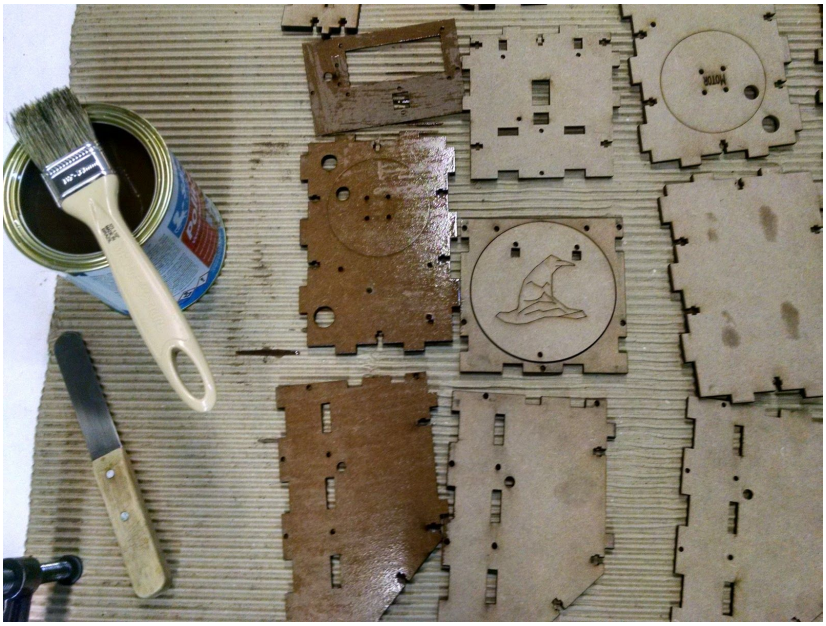
- KiCad installed (we don’t recommend the Linux version, due to that having a lot of bugs!)
- The .dxf , .stl, .ino code, found here:
  <O link aqui>

Instructions

1 - Cut the MDF frame with a laser cutter:

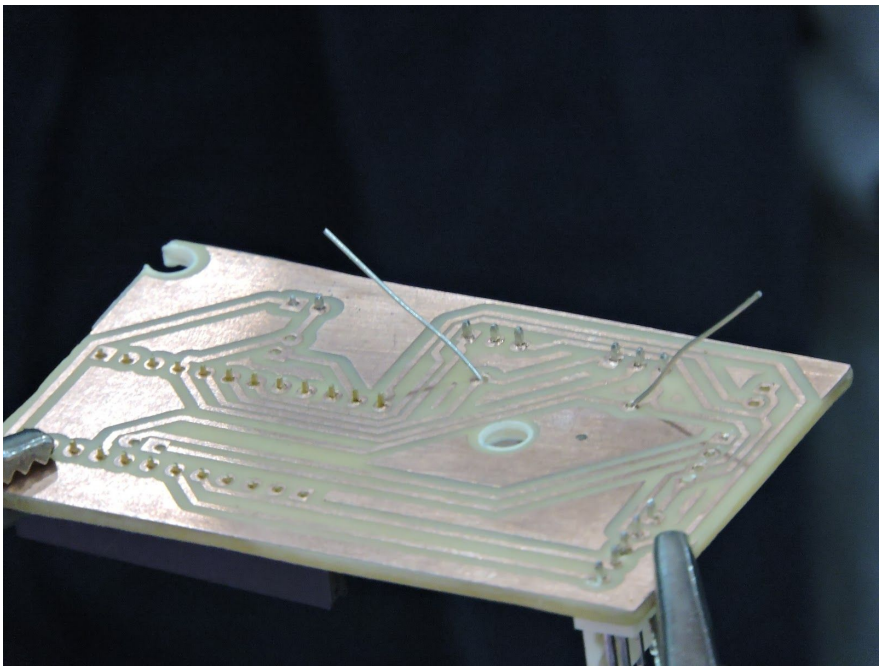


2 - Paint all MDF parts with varnish:

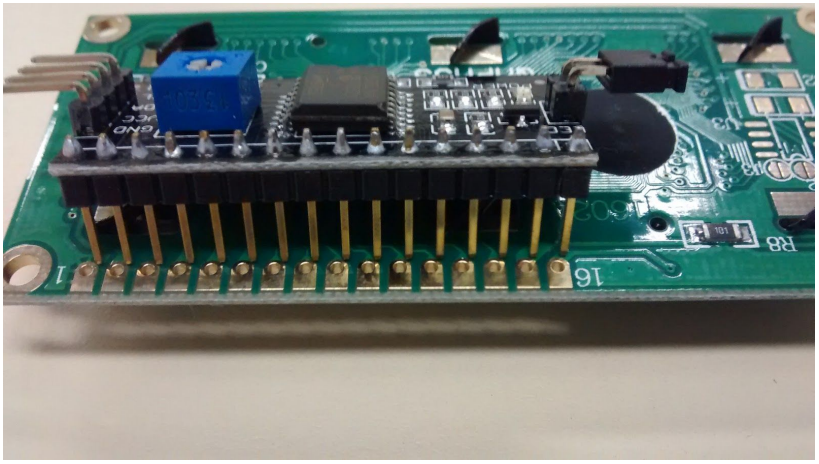


3 - Print the sensor hall support and the rotor in a 3D printer:

4 - Make the PCB: We recommend the UV light method for this.



5 - Weld the I2C interface to the LCD:

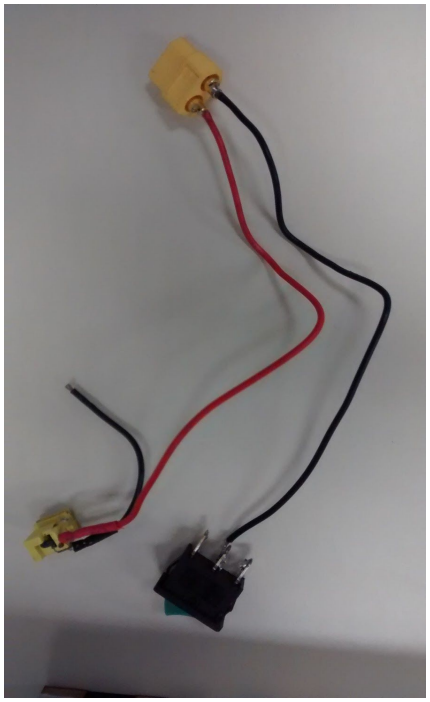


6 - Weld the male bullet connectors to the 3 motor wires and the female bullet connectors to the ESC output wires. Cover this connections with thermo-shrink:

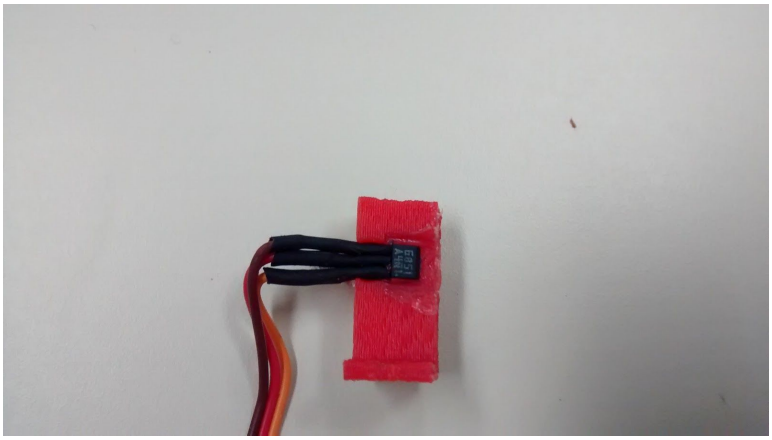
7 - Remove from the motor the two screws which fixed it to it's base:

8 - Weld the ESC voltage input wires to the XT60 female plug and cover that with thermo-shrink:

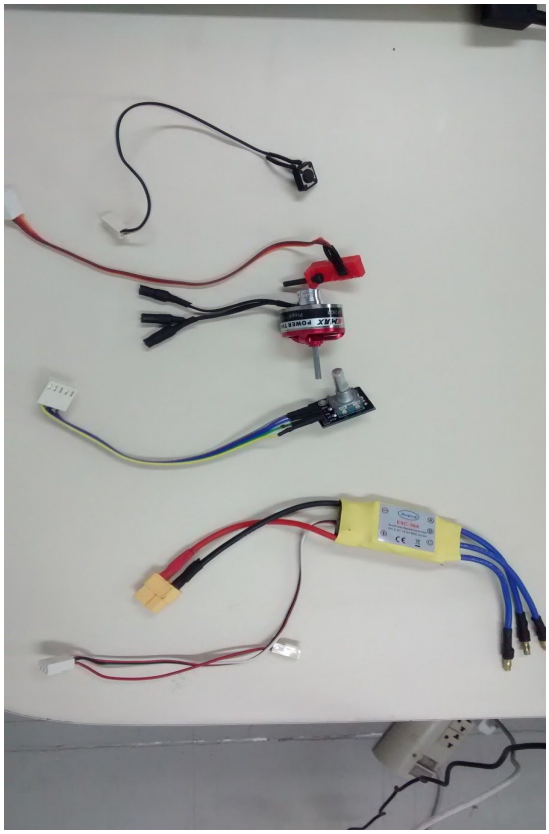
9 - Weld one wire of the DC jack to one of the XT60 plug, and weld the other pin of the XT60 plug to the second pin of the power switch:



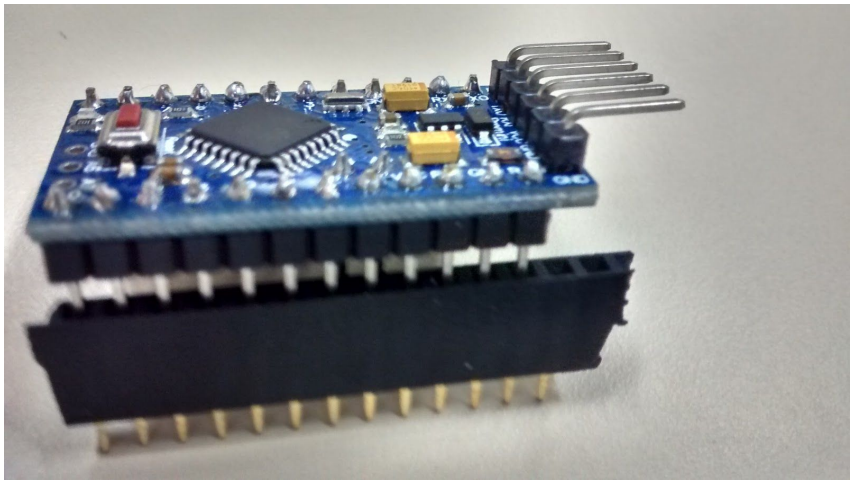
10 - Weld wires to the sensor hall pins and cover it with thermo-shrink. Glue the sensor hall to the sensor hall support: (careful to not use too much glue!)



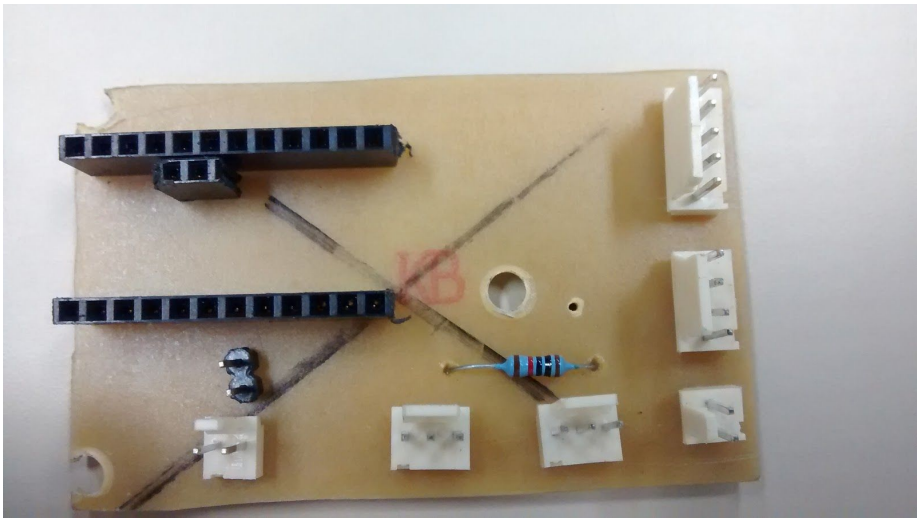
11 - Weld wires to the output pins of: the button, the rotary encoder, and the LCD I2C Arduino (if applicable). From now on we'll call these parts 'Modules'. To the live wires of all modules, attach the respective female plug pin, to be connected to male on the PCB. Pay attention to the KiCad schematics to correctly connect the wires to the plug. ***There is a high risk of short circuit if the wires are connected to the wrong position.***



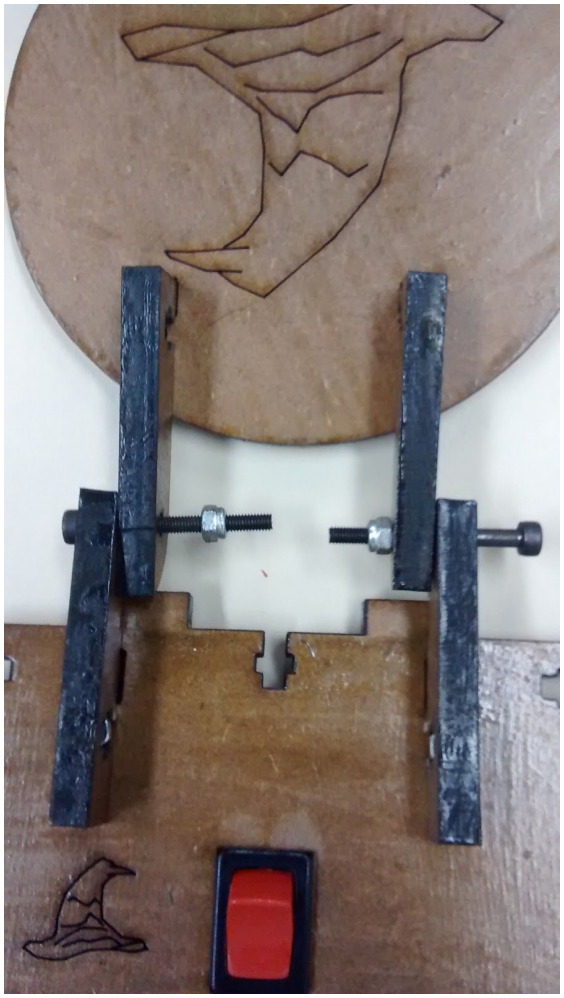
12 - Cut the female headers like the arduino footprint socket:

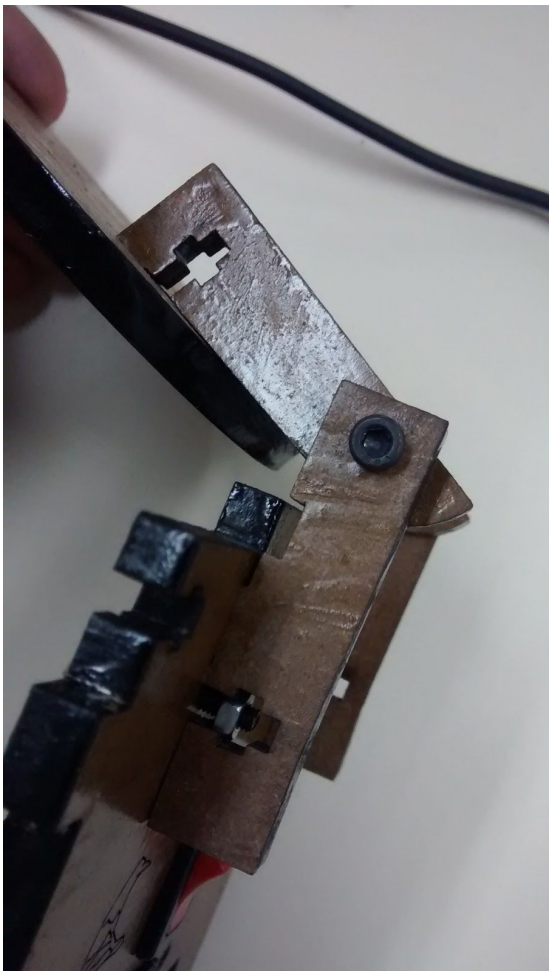


13 - Weld to the PCB the 2-pin, 3-pin, 4-pin and 5-pin sockets, the cut female headers, and the 10K resistor as shown: (Refer to the KiCad schematics so not to make mistakes)



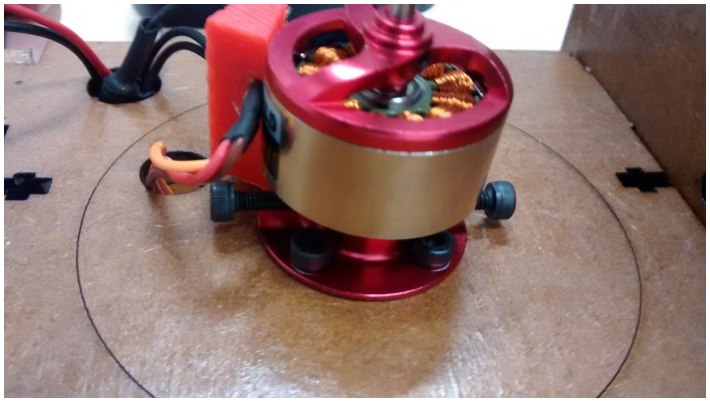
14 - Attach the hinge to the cover and back part:



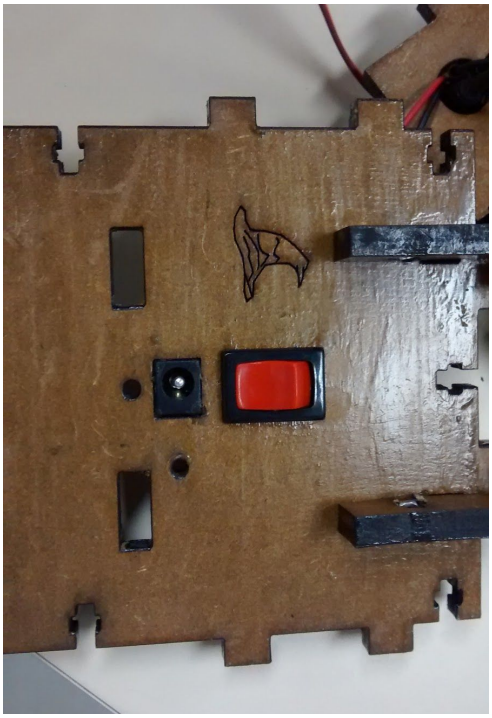


15 - Attach the motor base to the centrifuge base, with the sensor hall support, as shown:

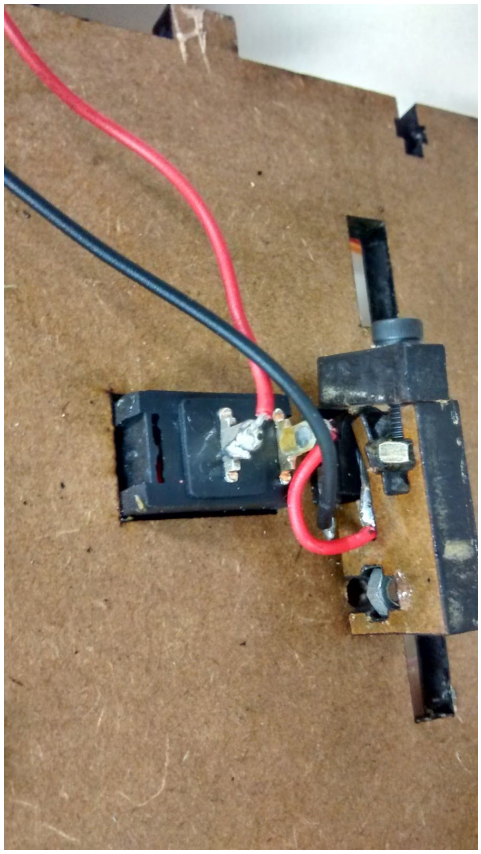
16 - Attach the screws to the motor again: (We recommend changing the original M3 screws for the conventional M3 used in the frame)



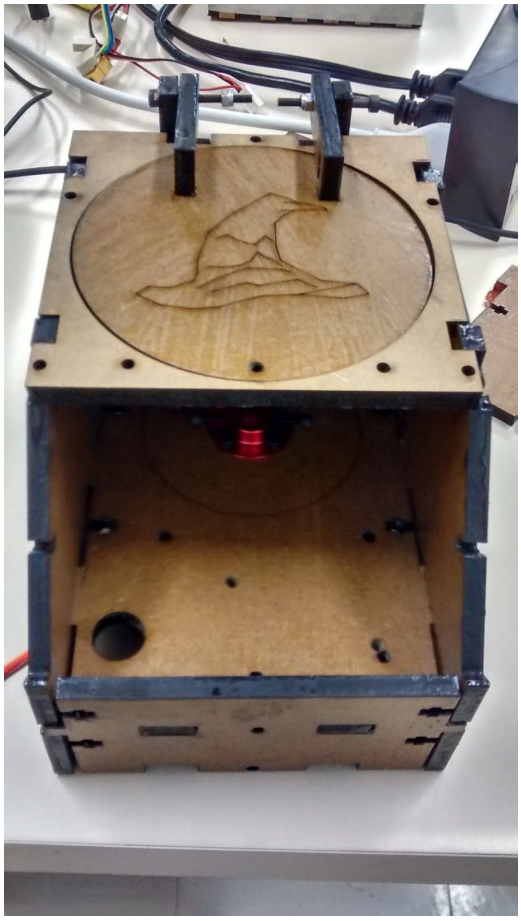
17 - Attach the power button and the DC jack in the back part:



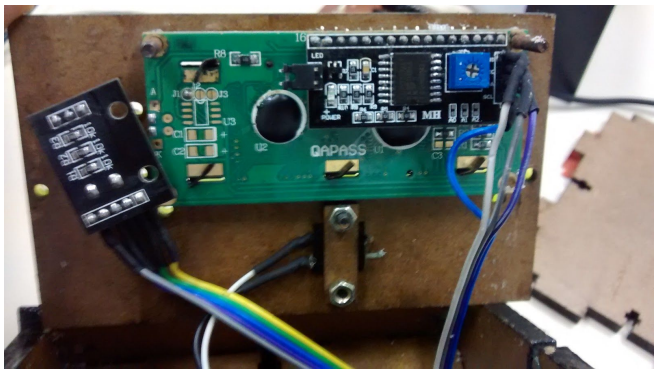
18 - Use the MDF DC jack support as shown:



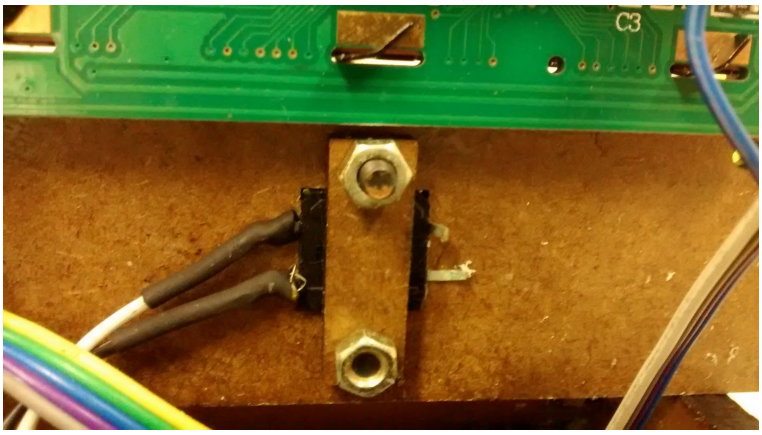
19 - Assemble all parts except the front panel and the lower base, as shown:



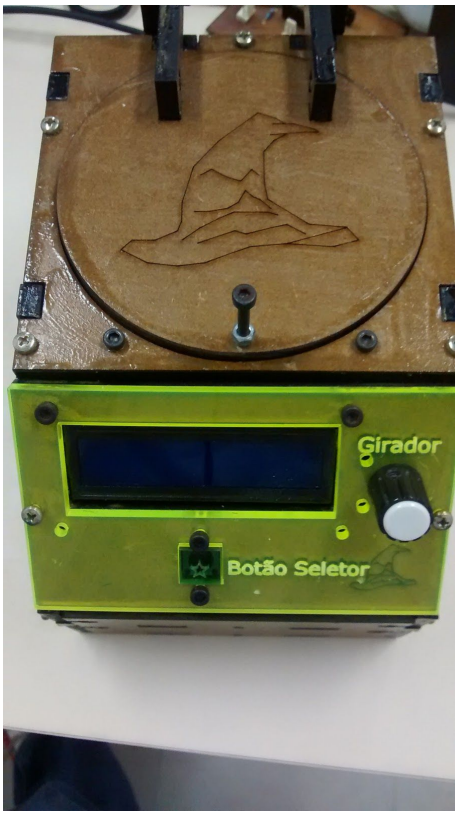
20 - Attach the LCD, rotary encoder, and button in the front panel, as shown:



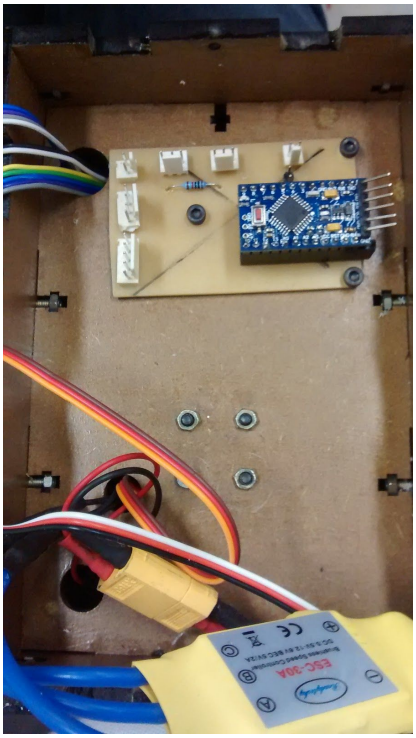
For the button support:



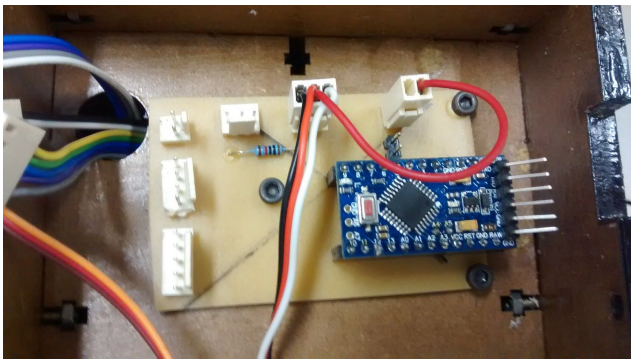
21 - Now fixate the front panel and the knob to the encoder:



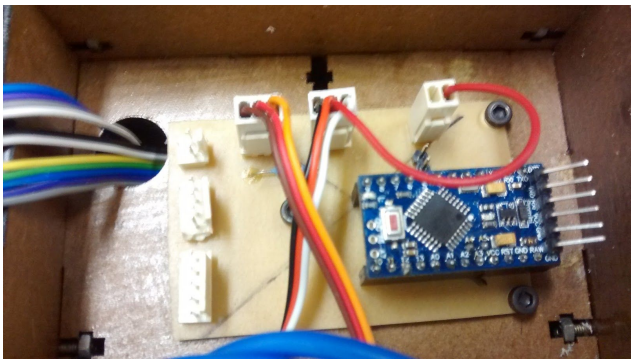
22 - Attach the PCB inside the bottom cavity, as shown:



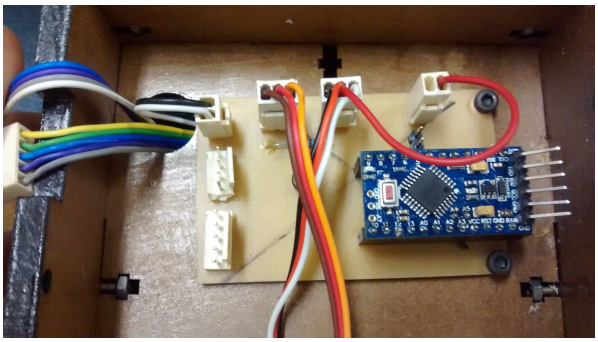
23 - Plug the ESC cable:



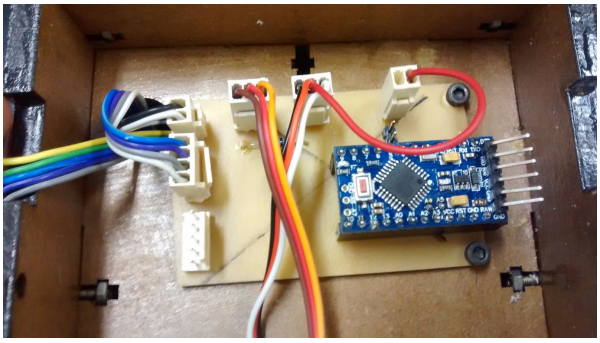
24 - The sensor hall:



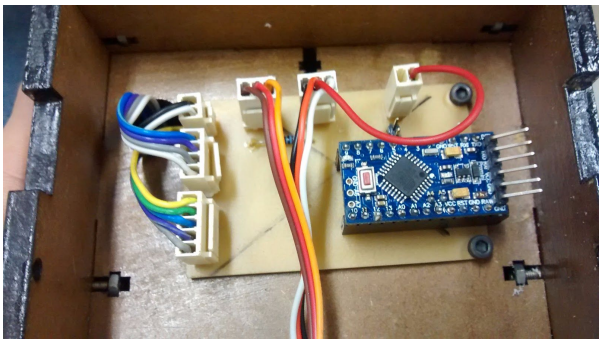
25 - The button:



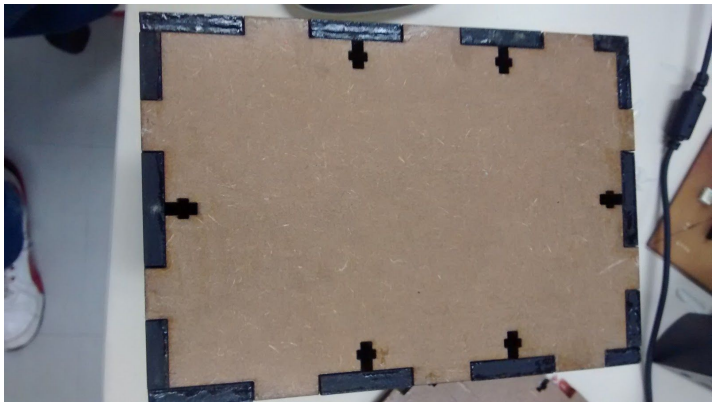
26 - The Encoder:



27 - And the LCD:



28 - Now, upload the arduino code as in this tutorial and close the inferior cavity:



29 - Attach the spinner to the rotor:

30 - Attach the 3D printed rotor:

31 - And your centrifuge is ready to fight!

Code

The software codes can be found back in
http://2016.igem.org/Team:USP_UNIFESP-Brazil/Hardware !